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EVALUATION OF A LABORATORY GIN FOR PROCESSING HAND-SNAPPED AND MACHINE-STRIPPED COTTON

By

I. W. Kirk, J. D. Bilbro, Jr., and L. L. Ray[1/]

Laboratory gins for ginning small-plot samples of cotton are valuable tools for cotton research. These gins enable research scientists to measure lint turnout, classer's grade index and staple length, and various fiber qualities from samples that are too small to be processed in a commercial gin.

Laboratory gins have been used for many years to process clean hand-picked cotton. The data obtained were considered reliable for measuring lint turnout and classer's grade index and staple length. Commercial gins of the hand-picking era had very simple cleaning machinery; consequently, laboratory gins gave results that were closely comparable to those from commercial gins. However, with the advent of rougher harvesting methods -- hand-snapping, machine-stripping, and machine-picking -- more elaborate cleaning equipment was installed in commercial gins. These developments created a problem in cotton research. Information obtained from laboratory gins was not representative of that which the producer obtained from a commercial gin, particularly when studies included varieties of cotton with stormproof bolls or when studies involved mechanized harvest.

In 1959 at Substation No. 8 of the Texas Agricultural Experiment Station, Lubbock, a laboratory gin system was designed to process small-plot samples of cotton that had been harvested by hand-snapping or machine-stripping. Basic cylinder cleaning, bur extraction, and saw-grid lint cleaning principles were incorporated into the laboratory system. The system was designed so that samples could be processed separately and rapidly. Three technicians can process approximately fifty 1,000-gram samples per hour on the system as installed.

1/ Agricultural engineer, Agricultural Engineering Research Division, Agricultural Research Service, U.S. Department of Agriculture; research agronomist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture; and assistant agronomist, Texas Agricultural Experiment Station. All are located at the Texas Agricultural Experiment Station, Lubbock.

The study reported here was made to evaluate the reliability of results obtained from the laboratory gin system. The objective of the investigation was to determine if the lint property measurements of classer's grade and staple length obtained from the laboratory gin were comparable to those obtained from a commercial gin.

Materials and Methods

Two stormproof cotton varieties were used for the gin comparison study. A range of grades and staple lengths was obtained by harvesting cotton on different dates from irrigated and dryland plots that had different preharvest treatments. Three harvest-aid chemical treatments and a check (no chemical) treatment were used on the dryland plots. Three harvest-aid chemical treatments, a check (no chemical) treatment, and a combination harvest (hand-harvesting of the early maturing bolls, followed by a late season machine-stripping of the remainder of the bolls) treatment were used on the irrigated plots. The plots were harvested with a mechanical stripper except as indicated on the combination harvest treatment. The treatments were replicated four times on the irrigated plots and six times on the dryland plots. Each replication was harvested and handled separately. One-thousand-gram bur cotton samples were taken from each harvested lot and were processed in the laboratory gin. The remainder of each harvested lot was then processed in a commercial gin. These lots ranged in size from one-half to one bale.

Both the laboratory and the commercial gins were designed for processing stripper-harvested cotton. The laboratory gin equipment was: 15-inch 4-cylinder grid bar cleaner, 14-inch extractor-feeder-cleaner, 10-saw gin, 12-inch saw-grid bar lint cleaner, and lint condenser. This installation is shown in figures 1 and 2. Operating data for the laboratory gin are presented

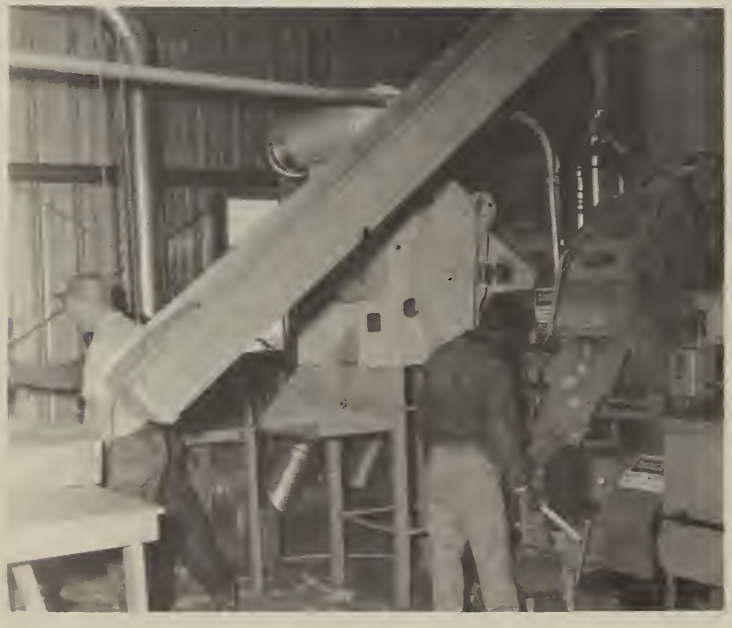

Figure 1. Laboratory gin system. Upper right is the cylinder cleaner; the extractor-feeder-cleaner is below the cylinder cleaner, and the 10-saw gin is below the feeder. The trough, foreground, is for conveying sample bags from overhead feed bin to lint weighing table, lower left.

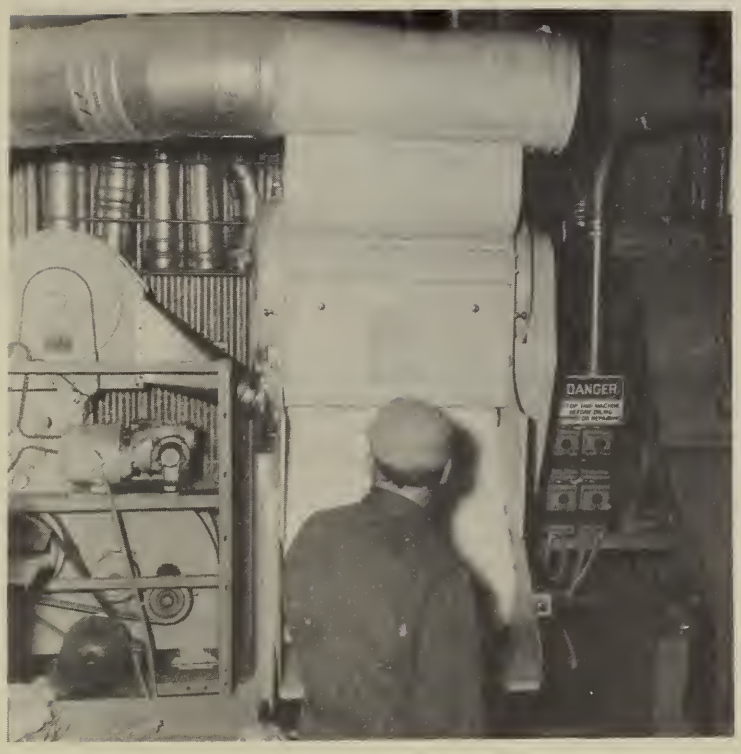

Figure 2. Laboratory gin system. Cylinder cleaner, extractor-feeder-cleaner, and gin are to the immediate right; the lint cleaner is in left background, the final lint condenser is in center foreground.

in tables 1 and 2. The commercial gin equipment was: rock and green boll trap 4-cylinder air line cleaner, 160° F. big reel drier, 72-inch 7-cylinder inclined screen cleaner, distributor, extractor-feeder-cleaner with air heated to 120° F., 5 90-saw huller-front gins, tandem double lint cleaners, condenser, tramper, and press. Overflow cotton from this installation was fed back to the distributor.

Lint samples were taken from each processed lot and were evaluated for classer's grade index and staple length, upper half mean length, and lint value. A statistical analysis was made of the 48 paired samples to determine if any differences existed between certain lint properties of cotton processed in the two gins. Lint turnout was not considered in the evaluation; however, results from a lint turnout uniformity study[2/] in the laboratory gin indicate that only four 1,000-gram samples are needed to reliably predict the true lint turnout from a given treatment. The standard deviation of mean lint turnout values was 0.31 percent and the coefficient of variation of lint turnout was 2.4 percent in these laboratory gin studies. Other tests have been made to determine adequate sample sizes for lint turnout determinations in laboratory gins.[3/] These tests indicated that samples as small as 800 grams gave reliable turnout values. The 1,000-gram samples used in this study were therefore considered large enough for comparable and reliable lint turnout values.

2/ Bilbro, J. D., Jr. Unpublished 1960 Annual Report, Crops Research Division, ARS, U.S. Dept. Agr. 1960.

3/ Johnson, A. J., and Looney, Z. M. Laboratory gins and tests of reliability of ginning with different sizes of seed cotton lots. U.S. Dept. Agr. Cir. 782, 13 pp. 1948.

Table 1. Laboratory gin air flow conditions, Lubbock, Texas, 1960[1/]

Location	Pipe size	Average water pressure			Air velocity	Air volume
		Velocity	Static	Total		
	inches	inches	inches	inches	ft./min.	c.f.m.
Extractor trash outlet	5 x 6	0.11	-0.47	-0.36	1,340	280
Cylinder cleaner trash outlet[2/]	6	.17	- .23	- .06	1,690	330
Trash fan exhaust[2/]	6	.73	.55	1.28	3,480	680
Between gin and lint cleaner[2/]	8	.23	- .68	- .45	1,940	680
Between lint cleaner and condenser	9 x 27	.05	- .64	- .59	870	1,470
Lint cleaner condenser outlet[2/]	11	.15	-2.25	-2.10	1,650	1,090
Lint condenser outlet[2/]	13	.20	-2.50	-2.30	1,930	1,780
Condenser exhaust[2/]	10	1.91	.41	2.32	5,620	3,060

1/ Since this study was designed to evaluate a specific installation and was not intended as ginning research, operational data are a matter of record and are not intended as recommendations.
2/ Diameter.

Table 2. Laboratory gin machinery speeds, Lubbock, Texas, 1960[1/]

Machine	Operating speed
	r.p.m.
Cleaner cylinders, 8" diameter	550
Extractor feeder drive	525
Gin saw, 10" diameter	540
Gin doffer brush, 12" diameter	1,770
Lint cleaner saw, 16" diameter	810
Lint cleaner doffer brush, 18" diameter	1,640
6" trash fan	3,020
#25 condenser fan	2,450

1/ Since this study was designed to evaluate a specific installation and was not intended as ginning research, operational data are a matter of record and are not intended as recommendations.

Results

Results of the statistical analyses of classer's grade index and staple length, upper half mean length, and the lint value are presented in table 3. The following conclusions could be drawn from these results: the commercial gin gave better lint grades with a probability level of P = 0.04; the laboratory gin gave better staple lengths, P = 0.025; and there was no significant difference between monetary values of the lint processed in the two gins, P = 0.40.

Table 3. Mean lint quality measurements for the laboratory and and commercial gins, Lubbock, Texas, 1960

Quality measurement	Laboratory gin	Commercial gin	P 1/	$S_{\bar{X}_D}$ 2/
Price-based classer's grade index 3/	31.69	32.09	0.04	0.191
Classer's staple length, 32nds inch	31.44	31.17	0.025	0.114
Fibrograph upper half mean length, inches	0.956	0.946	0.025	0.0042
Lint value, cents per pound	31.21	31.40	0.40	0.222

1/ Probability level.
2/ Standard deviation of the mean difference between paired samples.
3/ Price-based grade index - 1960 Lubbock "A" loan price for 1-inch staple length white cotton.

The lower lint grades from the laboratory gin were due primarily to the presence of more trash in the samples. However, the actual grade difference, even though statistically different at the 5-percent level, was only 14 percent of a full grade difference. This difference is so small that for all practical purposes, grades of the laboratory-ginned cotton may be considered on a par with those of the commercially ginned cotton. The shorter staple length for cotton processed in the commercial gin could probably be attributed to a combination of drying and more thorough cleaning in that gin. Research has shown a

significant tendency for shorter staple lengths to be associated with increases in drying and cleaning machinery. The actual difference in staple lengths was very small-approximately one-fourth of a length difference of 1/32nd of an inch.

The close relation between lint quality values obtained from the laboratory gin and those obtained from the commercial gin allows research workers to project small-plot observations to approximate conditions that would apply to a commercial cotton producer.

Summary

A small laboratory gin system, designed to process small plot samples of hand-snapped or machine-stripped cotton, was compared with a commercial gin to determine if the lint property measurements of classer's grade and staple from each were comparable.

The commercial gin gave only slightly better lint grades, the laboratory gin gave only slightly better staple lengths, and there was no significant difference in the monetary values of the lint from the two gins.

Since results obtained with this laboratory gin are representative of those obtained from a commercial gin, research workers can project small-plot observations to conditions that would apply to commercial cotton production.

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